



U.S. Army TRADOC Analysis Center  
Naval Postgraduate School  
Monterey, CA 93943



*TRAC-MONTEREY*

RESEARCH PLAN  
of the  
U.S. ARMY TRADOC ANALYSIS CENTER  
(TRAC) - MONTEREY  
*Center for  
Advanced Simulation Concepts Research*  
for  
FISCAL YEAR 1999

**Lieutenant Colonel Michael L. McGinnis, Ph.D.**  
Director, TRAC-Monterey  
Monterey, California

**Mr. Michael F. Bauman, SES**  
Director, TRAC  
Fort Leavenworth, Kansas



# Table of Contents

<b>I. TRAC-MONTEREY ADVANCED SIMULATION RESEARCH CENTER .....</b>	<b>1</b>
Purpose .....	1
Organization and Facilities.....	1
Personnel .....	2
<b>II. RESEARCH PROGRAM .....</b>	<b>3</b>
Purpose of the Research Plan .....	3
Annual Research Cycle .....	3
<b>III. ADVANCED SIMULATION RESEARCH FOR FY99 .....</b>	<b>5</b>
Automated Universal Data Collection and Analysis Tool (AUDCAT).....	5
Distributed Interactive Simulation Combat System (DISCS) Customer Support .....	7
Dynamic Scenario Builder (DSB) .....	9
JADS Joint Test Force.....	11
Hla Federate for Data Collection and Analysis .....	13
HLA Warrior .....	16
Land Warrior Simulation and Training Support .....	18
Modular Terrain for Entity Level Computer Generated Forces (ModTerrain).....	20
Onesaf Verification and Validation.....	23
Standard Scenario Mark-Up Language (S2ML) .....	25
<b>IV. MILITARY OPERATIONS RESEARCH FOR FY99 .....</b>	<b>27</b>
A Graph And Network Component for Dynamic Planning in a Loosely Coupled System (König).....	27
Army Center for Acquisition Lessons Learned .....	29
Combat Identification (CID) Project .....	31
Forecasting Tools for Military Housing Requirements.....	33
Land Warrior Training Effectiveness Analysis.....	35



## **I. TRAC-MONTEREY ADVANCED SIMULATION RESEARCH CENTER**

### **Purpose**

TRAC-Monterey provides a small, full-time analytical capability to the U.S. Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC). Key TRAC-Monterey functions include the following.

- Accomplish research in two major areas: (1) high-level computer simulations concepts and advanced technologies for modeling military operations focusing on system interoperability in distributed environments; and (2) practical, real-world military operations research problems of importance to the Army.
- Sustain a strong outreach program that maintains close ties between TRAC and various Army commands and agencies.
- Provide professional development opportunities for Army officers assigned to TRAC-Monterey from the FA49 community that enhance their skills, knowledge and experiences as both military officers and operations research analysts.
- Sponsor practical, academically and professionally enriching military oriented “experience tours,” course projects and Masters Theses for officers from all branches of service attending the Naval Postgraduate School (NPS).

TRAC-Monterey’s two major research thrusts, leading edge computer simulation research and current military operations research problems, ensure the Center remains relevant and closely linked with the Army.

The Center’s research initiatives are supported by world-class faculty and students from the Naval Postgraduate School (NPS). TRAC-Monterey’s research program offers NPS faculty a broad range of opportunities for studying meaningful, challenging applied problems that support NPS curricula and enhances professional development.

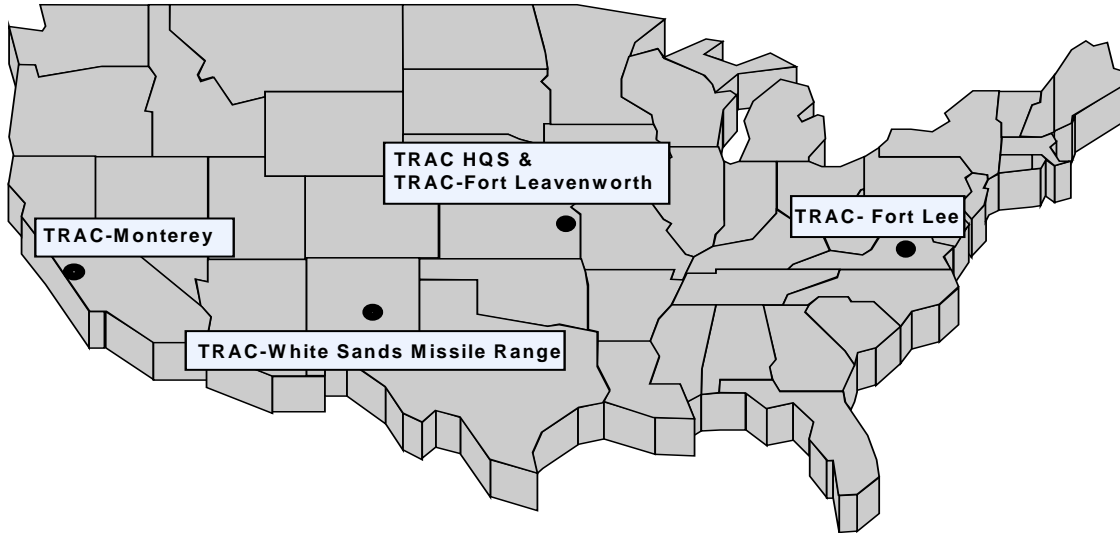
The Center’s research program also supports students from all branches of military service and allied officers with opportunities to investigate a wide range of interdisciplinary issues. TRAC’s research program is particularly well suited to military officers who wish to apply many of the operations research, applied mathematics, engineering, and computer science concepts studied in the classroom to solving real-world military problems.

### **Organization and Facilities**

TRADOC Analysis Center (TRAC) Headquarters is located at Fort Leavenworth, Kansas. TRAC-Monterey is one of four analysis centers organized under TRAC Headquarters. The other centers shown in the figure below are TRAC-Fort Leavenworth, Kansas, TRAC-White Sands Missile Range, New Mexico, and TRAC-Fort Lee, Virginia.

TRAC-Monterey is located on the grounds of the Naval Postgraduate School, Monterey, California, and occupies office and laboratory space on the second and third floors of Building 203. Facilities on the 2d floor include offices for the director, analysts, administrative personnel, plus a conference room. There is a combat simulation laboratory, contractor work areas, and a second briefing area on the 3d floor.

**Figure 1. U.S. Army TRADOC Analysis Center (TRAC) Offices**



## Personnel

The TRAC-Monterey Table of Distribution and Allowances (TDA) authorizes a director (O5), six military operations research analysts (O4/O3), and an administrative staff. An important step in developing military leaders of tomorrow is providing them with opportunities to develop their research and problem-solving skills while working on problems of importance to the Army. As mentioned above, TRAC-Monterey accomplishes this through a comprehensive research program that also maintains the Center's ties to the Army.

The full-time TRAC-Monterey analysts responsible for accomplishing the *Annual Research Plan for Fiscal Year 1999* are identified below.

**Table 1. TRAC-Monterey Research Council**

POSITION	NAME	PHONE	EMAIL
Director, TRAC	Mr. Michael F. Bauman, SES	DSN: 688-5132	baumanm@trac.army.mil
Director, TRAC-Mtry	LTC Michael L. McGinnis, Ph.D.	DSN: 878-3088	mcginnim@trac.nps.navy.mil
Analyst	Ms. Pamela I. Blechinger, GS-13, M.Sc.	(415) 751-8855	<a href="mailto:blechinp@trac.army.mil">blechinp@trac.army.mil</a>
Analyst	MAJ Leroy A. Jackson, M.Sc.	DSN: 878-4061	jacksonl@trac.nps.navy.mil
Analyst	MAJ William S. Murphy, Jr., M.Sc.	DSN: 878-4056	murphyw@trac.nps.navy.mil
Analyst	MAJ Gerald M. Pearman, M.Sc.	DSN: 878-4062	pearmanm@trac.nps.navy.mil

**Table 1. TRAC-Monterey Research Council (Continued)**

POSITION	NAME	PHONE	EMAIL
Analyst	CPT(P) Theodore D. Dugone, M.Sc.	DSN: 878-4057	dugonet@trac.nps.navy.mil
Analyst	Ms. Shirley M. Pratt, GS-12, M.Sc.	(407) 673-3610	<a href="mailto:pratts@gdi.net">pratts@gdi.net</a>
Analyst	SFC Cary C. Augustine	DSN: 878-4059	augustic@trac.nps.navy.mil

TRAC-Monterey augments its research capability through several sources. A major source of support comes from NPS faculty who conduct TRAC sponsored research. A second source is NPS Masters students who work on TRAC-sponsored projects and who are advised by NPS faculty. Finally, private contractors provide software development, programming support, and also help with proof-of-principle demonstrations.

## II. RESEARCH PROGRAM

### Purpose of the Research Plan

The *Annual Research Plan* formalizes TRAC-Monterey's research and problem-solving activities for the upcoming fiscal year. The Plan provides a concise summary of each applied research or problem solving project undertaken by TRAC-Monterey. The summaries include the client organization, point(s) of contact, problem statement, proposal of work, project requirements and deliverables, estimates of milestones and man-years to complete the work, and TRAC analyst(s) undertaking the work.

As mentioned above, TRAC-Monterey provides Army agencies with dedicated, long-term, applied research specializing in computer simulation interoperability as well as the application of operations research and applied mathematical methods to solve real world problems. The *Annual Research Plan* also serves as a means of announcing TRAC-Monterey's research activities to other TRAC offices, NPS faculty and students, and various agencies throughout the Department of Defense.

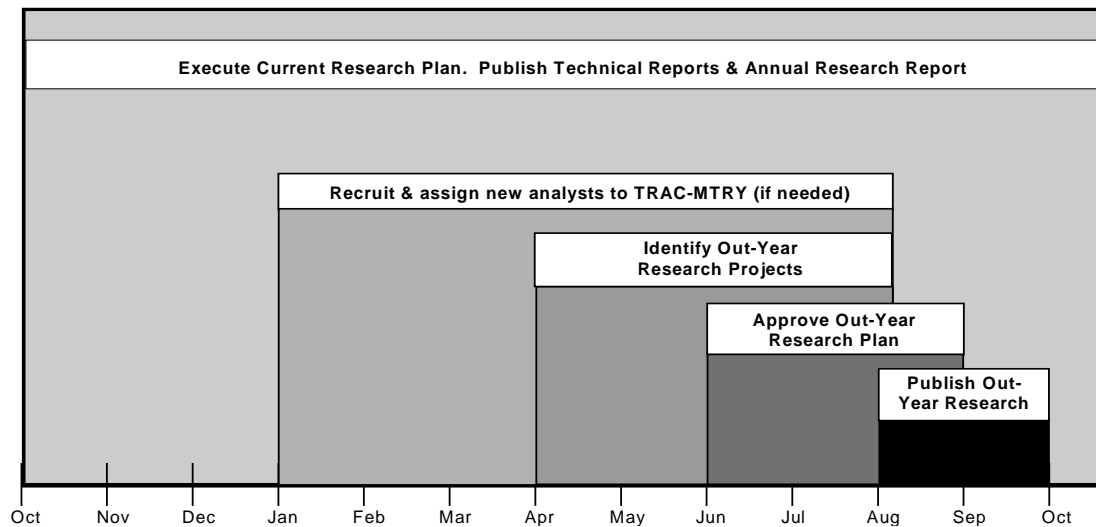
### Annual Research Cycle

The Annual Research Cycle for TRAC-Monterey begins in October and continues through the middle of October of the following year. The major phases of the research cycle are illustrated in Figure 2 below. The bands depict the time periods for accomplishing major tasks in each phase of the annual research cycle, (see white text boxes running across each shaded band).

The research cycle begins with identification of potential research projects for the upcoming fiscal year. Potential projects include new and on-going projects (i.e., those carried forward from the current year). During this phase, TRAC-Monterey analysts prepare research proposals for each potential project (Sections III & IV).

In the second phase, the TRAC-Monterey Research Council (Table 1) reviews each project proposal. The Council assesses the potential value of the project to the Army, its contribution to TRAC-Monterey's major research thrusts for the upcoming year, ability and interest of TRAC-Monterey analysts to conduct the study, level of effort required, and project funding. In balancing these issues, TRAC-Monterey may occasionally execute unfunded or unforecasted projects that have a high payoff for the Army, TRAC, and the analyst accomplishing the research. All research projects currently approved for the upcoming fiscal year are included in the Center's *Annual Research Plan*.

**Figure 2. TRAC-Monterey Research Cycle**



The final phase involves execution of the research plan. A technical report is produced for each research project undertaken that documents work performed by TRAC-Monterey. Publication of the Center's *Annual Research Report*, summarizing research accomplished by TRAC-Monterey during the previous year and notable briefings and presentations, completes the annual research cycle. Each phase of the research cycle is sequenced with both the selection of incoming TRAC-Monterey analysts and the academic year of the Naval Postgraduate School.



### **III. ADVANCED SIMULATION RESEARCH FOR FY99**

#### **AUTOMATED UNIVERSAL DATA COLLECTION AND ANALYSIS TOOL (AUDCAT)**

##### **PROJECT FY99-01**

##### **CLIENT ORGANIZATION**

U.S. Army Aviation and Missile Command (AMCOM), ATTN: AMSAM-RD-SS-AA (L. Fraser), Redstone Arsenal, AL 35898-5000. Point of Contact: Ms. Laurie Fraser, Director. DSN: 788-0942. *lfraser@redstone.army.mil*

##### **PROBLEM STATEMENT**

Data collection and analysis are central issues in distributed simulation and important to all Army M&S domains. It affects the conduct of studies, testing and experimentation, and the preparation of after action review products. State of the art M&S technologies are required to effectively collect and analyze data from distributed High Level Architecture (HLA) simulation sessions. Previous TRAC-Monterey research entitled "A Federate for Data Collection and Analysis" designed and implemented automated procedures for joining any HLA Federation using any Federation Object Model (FOM) in order to collect data for analysis. That project used Vision XXI software as a graphical user interface (GUI). The Vision XXI GUI required the system to map collected data to the Vision XXI standard data representation before it could be analyzed.

The AMCOM Data Collection and Analysis Tool (DCAT) currently provides the analyst with the ability to query data generated from Distributed Interactive Simulation (DIS) experiments. However, DCAT does not perform these queries on databases that contain arbitrary object representations.

Various agencies would like to use native FOM object representations when they analyze data from distributed HLA simulations. This approach requires analysts to adapt their techniques to different FOM object representations they encounter. New analysis techniques will require arbitrary queries on data in native FOM object representations. This approach will eliminate the requirement to manually write FOM specific mappings to standard data representations.

##### **PROPOSAL OF WORK**

This project proposes to deliver a software product that will automate procedures for using arbitrary queries to perform analysis in HLA federations for different FOM object representations. TRAC-Monterey, partnering with AMCOM and funded by SIMTEC will use previously developed Analysis Federate listener functionality to automatically subscribe to High Level Architecture (HLA) data from any Federation that uses a Federation Object Model (FOM). TRAC-Monterey will make this information available in a database format to AMCOM's DCAT analysis tool. AMCOM will modify DCAT to provide the functionality that allows arbitrary database queries using arbitrary object models.

### PROJECT REQUIREMENTS AND MILESTONES

- Completion of Database Schema Generator and Data Subscription Module (AMCOM, MAY 1999)
- Completion of Database Generator (TRAC-Monterey, MAY 99)
- Integration Complete (AMCOM & TRAC-Monterey, SEP 99)
- Completion of Testing (AMCOM & TRAC-Monterey, DEC 99)
- Delivery of Executable Software (AMCOM & TRAC-Monterey, DEC 99)
- Deliver Technical Report (AMCOM & TRAC-Monterey, MAR 00)

### PROJECT DELIVERABLES

- Executable software AUDCAT prototype.
- Technical report.

### ESTIMATED MAN-YEARS REQUIRED

Requirements	Lead Investigator	Co-Investigator
Completion of Database Schema Generator and Data Subscription Module	0	TBD
Completion of Database Generator Integration Complete	1/6	0
Completion of Testing	1/6	TBD
Delivery of Executable Software	1/4	TBD
Deliver Technical Report	1/6	TBD

### LEAD INVESTIGATOR

MAJ William S. Murphy Jr., TRAC-Monterey, P.O. Box 8692, Monterey, CA 93943. DSN 878-4056. *murphyw@trac.nps.navy.mil*

### CO-INVESTIGATORS

Ms. Laurie Fraser, U.S. Army Aviation and Missile Command (AMCOM), ATTN: AMSAM-RD-SS-AA (L. Fraser), Redstone Arsenal, AL 35898-5000. DSN: 788-0942. *lfraser@redstone.army.mil*

MAJ Leroy A. Jackson, TRAC-Monterey, P.O. Box 8692, Monterey, CA 93943. DSN 878-4061. *jacksonl@trac.nps.navy.mil*

**CONTRACTOR:** None.

### REFERENCE

Fraser, Laurie, "SIMTECH Project Implementation Plan," 22 September 1998.

## **DISTRIBUTED INTERACTIVE SIMULATION COMBAT SYSTEM (DISCS) CUSTOMER SUPPORT**

**PROJECT FY99-02**

**CLIENT ORGANIZATION: TBD**

**POINT OF CONTACT: TBD**

### **PROBLEM STATEMENT**

The Distributed Interactive Simulation Combat System (DISCS) provides Janus users an opportunity to interact with constructive, virtual, and live simulations using DIS protocols. It is currently under configuration management by TRAC-Monterey and fielded to all three modeling domains: TEMO, RDA, and ACR. Although DISCS was designed to ensure ease of use, new applications often require DISCS code modifications to address a specific test, training, or analytical need.

### **PROPOSAL OF WORK**

Continuous support to Army and Joint warfighting experiments linking the following simulations and simulators through DISCS:

- Battlefield Distributed Simulation - Developmental (BDS-D).
- Large Scale Simulation Networking (SIMNET).
- F-16 Synthetic Flight Training System (SFTS).
- Virtual Unmanned Aerial Vehicle (UAV).
- Joint Surveillance Target Attack Radar System (JSTARS) Simulator.
- Close Combat Anti-Armor Weapon System-Concept Emulator (CCAWS-CE).
- Target Acquisition Fire Support Model (TAFSM).
- MH-60K Combat Mission Simulator (CMS).
- Interactive Tactical Environmental Management System (ITEMS).
- Extended Air Defense Simulation (EADSIM).
- Sound Storm.
- Simulyzer.
- Modular Semi-Automated Forces (ModSAF).
- MH-60K Combat Mission Simulator.
- AC-130U Battle Management Center.

Extend DISCS capabilities to enhance interaction with this current federation of models and others, as requested. This work is resource dependent and generally accomplished in three sequential phases.

- |                 |  |
|-----------------|--|
| <u>Phase 1:</u> | Determine entity and terrain database information transfer requirements between DISCS and applicable model(s).     |
| <u>Phase 2:</u> | Modify DISCS code as required and test at TRAC-Monterey.   |
| <u>Phase 3:</u> | Conduct DISCS proof-of-principle demonstration (POP-D) using applicable models on-site at the customer's location. |

## PROJECT REQUIREMENTS AND MILESTONES (TO BE DETERMINED)

- Determine information transfer requirements between DISCS and applicable model(s).  
Verify correct enumeration of DIS PDUs and identify non-standard PDUs.
- Verify hardware/operating system capabilities at customer location.
- Customer provides TRAC-Monterey with entity and terrain databases.
- Test DISCS at TRAC-Monterey.
- Conduct DISCS proof-of-principle demonstration (POP-D) at customer location prior to exercise.
- Provide on-site support to customer as required during exercise.

## PROJECT DELIVERABLES

- Technical report discussing research results for each phase of the problem.
- Executable version of DISCS.
- Technical support.

## ESTIMATED MAN YEARS REQUIRED

Phase	Requirements	Lead Investigator	Programmer
1	Determine information transfer requirements.	TBD	TBD
2	TRAC-Monterey work.	TBD	TBD
3	POP-D at offsite location and exercise support.	TBD	TBD

## LEAD INVESTIGATOR

CPT(P) Theodore D. Dugone, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. DSN: 878-4057. *dugonet@trac.nps.navy.mil*

## CO-INVESTIGATOR

SFC Cary Augustine, TRAC-Monterey, PO BOX 8692, Monterey, CA 93943. (831) 656-4059 (DSN 878). *augustic@mtry.trac.nps.navy.mil*

## CONTRACTOR

Rolands & Associates (R&A), Mr. William Caldwell, 500 Sloat Avenue, Monterey, CA 93940. (831) 373-2841.

## REFERENCES

- Pate, Maria C., William J. Caldwell, David J. Ward, "Janus Fast Movers," US Army TRADOC Analysis Center-Monterey Technical Report No. R93WJ, 10 August 1995.
- Roussos, Glen G. And Maria C. Pate, "Janus Linkages to DIS (JLINK)," US Army TRADOC Analysis Center-Monterey Technical Report No. NPS-TA-96001, 9 October 1996.
- Pearman, Gerald M, "Comparison Study of Janus and JLink," Naval Postgraduate School, Monterey, CA, June 1997.

## **DYNAMIC SCENARIO BUILDER (DSB)**

### **PROJECT FY99-03**

#### **CLIENT ORGANIZATION**

US Army Simulation, Training, and Instrumentation Command (STRICOM), 12249 Research Parkway, Orlando, FL 32826. Point of Contact: LTC George Stone, JSIMS JPO, 12249 Science Drive, Suite 260, Orlando, FL 32826. 407-384-5554 (DSN) 970-5554.  
*George\_Stone@jsims.mil*

#### **PROBLEM STATEMENT:**

Current simulation tools do not allow users to rapidly build scenarios using validated data sources. Often, data and information required for scenarios are not easily accessible. Therefore, new simulation scenarios must be either copied from a previous exercise or built from "scratch." Functional Descriptions of Army and Joint Battlespaces were created for the WARSIM and JSIMS programs, respectively. These descriptions will be validated by training and doctrine authorities and then maintained in repositories. Simulation developers need access to the plethora of data available to the exercise director's staff.

#### **PROPOSAL OF WORK**

Improve the design and functionality of the Dynamic Scenario Builder (DSB) for simulation scenario creation via an internet-based repository of data. The DSB prototype consisting of eight Scenario Generation Modules, will be accessed via a web-based system that "pulls" data into the DSB. The DSB may emulate Functional Description of the Battlespace and Joint Conceptual Model of the Mission Space repositories until DSB maturity allows direct web-based access.

#### **REQUIREMENTS AND MILESTONES**

- Develop initial goals and objectives based on demonstration of DSB work completed by United States Military Academy Artificial Intelligence Center(OCT/NOV 98)
- Create implementation plan and propose several alternatives to client POC before proceeding with the DSB project. (DEC 98)
- Review and setup DSB prototype for augmentation. (JAN 99)
- Build Module #4: *Establish Theater of Operations* (FEB 99)
- Build Module #5: *Establish Communications Infrastructure* (MAR 99)
- Build Module #6: *Identify Logistics Environment* (APR 99)
- Build Module #7: *Establish Initial Intelligence Picture* (MAY 99)
- Build Module #8 *Identify STARTEX Positions* (JUN 99)
- Demonstrate DSB Alpha version (JUL 99)
- Conduct DSB Beta testing (AUG 99)
- Complete DSB prototype and Final Technical Report/Presentation (OCT 99)

#### **DELIVERABLES**

- Monthly one-page status reports.
- DSB prototype demonstration.
- Technical report.

**ESTIMATED MAN YEARS**

Requirement	Lead Investigator
Develop initial goals and objectives.	1/12
Create implementation plan.	1/12
Review and setup DSB prototype for augmentation.	1/12
Build Module #4.	1/12
Build Module #5.	1/12
Build Module #6.	1/12
Build Module #7.	1/12
Build Module #8.	1/12
Demonstrate DSB Alpha version.	1/12
Conduct DSB Beta testing.	1/12
Complete DSB Prototype and Final Technical Report/Presentation.	1/6

**LEAD INVESTIGATOR**

CPT(P) Theodore D. Dugone, TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-4057 (DSN 878). *dugonet@trac.nps.navy.mil*

**CO-INVESTIGATOR**

MAJ Leroy A. Jackson, TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-3086 (DSN 878). *jacksonl@trac.nps.navy.mil*

**CONTRACTOR**

Sherikon, Mr. George Dahm, 12249 Science Dr. Suite 140, Orlando, FL 32826. (407) 281-6197. *gdahm@sherikon.com*

**REFERENCE**

Stone George F. III and Michael L. McGinnis. Building Scenarios in the Next Generation of Simulations. Proceedings, 1998 IEEE International Conference on Systems, Man, and Cybernetics.

## **JADS JOINT TEST FORCE**

### **PROJECT FY99-04**

#### **CLIENT ORGANIZATION**

JADS Joint Test Force, 11104 Menaul Blvd. NE, Albuquerque, NM 87112-2454. Point of Contact: MAJ Michael L. Roane, JADS Analysis Team Lead. DSN: 242-0974.  
*roane@jads.kirtland.af.mil*

#### **PROBLEM STATEMENT**

The JADS Joint Test Force is conducting a test to determine the merits of using HLA to support the research, development, and acquisition process. This test requires data collection, analysis, and visualization support. The task force conducting testing would like to use the Analysis Federate to support this effort. This project requires mapping the JADS FOM into objects compatible with the Analysis Federate's Vision XXI object model.

#### **PROPOSAL OF WORK**

TRAC-Monterey will modify Analysis Federate functionality to support JADS testing.

#### **PROJECT REQUIREMENTS AND MILESTONES**

- Complete FOM Mapping. (NOV 98)
- Participate in Federation Integration Testing. (NOV 98)
- Complete Visualization and Analysis Integration. (NOV 98)
- Participate in Joint Test. (DEC 98)
- Complete Technical Report. (APR 99)

#### **PROJECT DELIVERABLES**

- Executable software version.
- Exercise support.
- Technical report.

#### **ESTIMATED MAN-YEARS REQUIRED**

Requirements	Lead Investigator
Complete FOM Mapping.	1/12
Participate in Federation Integration Testing.	1/24
Complete Visualization and Analysis Integration.	1/12
Participate in Joint Test.	1/24
Complete Technical Report.	1/12

#### **LEAD INVESTIGATOR**

MAJ William S. Murphy Jr., TRAC-Monterey, P.O. Box 8692, Monterey, CA 93943. DSN 878-4056. *murphyw@mtry.trac.nps.navy.mil*

#### **CO-INVESTIGATOR**

CPT(P) Theodore D. Dugone, TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-4057 (DSN 878). *dugonet@trac.nps.navy.mil*

**CONTRACTOR:** None.

**REFERENCE:** None.



## **HLA FEDERATE FOR DATA COLLECTION AND ANALYSIS**

### **PROJECT FY98-07**

#### **CLIENT ORGANIZATION**

Headquarters, U.S. Army TRADOC Analysis Center (TRAC), ATTN: ATRC, Fort Leavenworth, KS 66027. Point of Contact: Mr. Michael F. Bauman, SES, Director, TRAC, Fort Leavenworth, KS 66027. DSN: 552-5132. *baumanm@trac.army.mil*

#### **PROBLEM STATEMENT**

The quality of studies, tests, experiments, or after action reviews (AARs) depends, in large measure, on accurate, timely, and relevant data. This is true in all simulation domains: Advanced Concepts and Requirements (ACR), Research Development and Acquisition (RDA), and Training, Exercises and Military Operations (TEMO).

Conventional, closed simulations generally feature built-in capabilities for data logging and post-processing. Data collection in Distributed Interactive Simulations (DIS) is usually accomplished through top-down, network data logging procedures. Unfortunately, this often generates overwhelming amounts of data, most of which may not be relevant to the study. In addition, data overload makes reconstructing and analyzing simulation events by correlating locally logged simulation data from multiple sources a nearly impossible task.

As advanced modeling and simulation (M&S) technologies such as High Level Architecture (HLA), gain acceptance across all domains, new methods for collecting and analyzing data are required. However, the M&S community have neither developed nor accepted any approaches for data collection and analysis in a HLA environment. This is due, at least in part, to the unique challenges of collecting and analyzing data in HLA. For example, selective subscription to objects, attributes, and interactions is required to avoid the data overload and other pitfalls associated with recording all network traffic. Additionally, the need for real-time data processing (RTDP) in HLA is especially important during training simulation sessions in order to provide immediate feedback during man-in-the-loop training to maximize learning. These capabilities will unquestionably improve the quality and timeliness of feedback during after action reviews from simulation sessions in all domains. However, to achieve this level of performance requires new protocols, procedures, and tools for data collection and analysis.

#### **PROPOSAL OF WORK**

What is needed is a general purpose analysis tool for conducting studies in a HLA environment that only collects and analyzes requisite data relevant to issues under consideration. To meet this need, TRAC-Monterey proposes to design and prototype an Analysis Federate for data collection and analysis in HLA-based simulation environments. HLA federates include simulations and other applications such as simulation managers, entity interfaces, passive viewers, and data collectors.

Analysis Federate design, development, and implementation will comply with industry specifications, standards, and protocols for HLA federates. The HLA compliant Analysis Federate prototype proposed will employ the Run-Time Infrastructure (RTI) when subscribing to federation objects and interactions for data collection and analysis. The Federate will require identification of performance measures and data requirements ahead of time. This is a significant departure data collection in DIS where all data must be collected and stored for later use. With the Analysis Federate, data subscription collects selected data that will be correlated and processed in real time, thereby substantially reducing the amount of data collected.

The Analysis Federate will also provide users with derived, or processed, federation data. Derived data includes statistical data such as means and measures of effectiveness like “loss exchange ratios. Other key features of the Analysis Federate include dynamic data storage and exchange, and reconfigurable graphic user interfaces (GUI) for archiving, processing, and presenting data. This will require development of a HLA RTI compatible GUI that enables system users to specify data requirements for an exercise, identify data to be collected in HLA using subscription and logging, and identify essential data analysis requirements during and after federated simulation execution. Development of the Analysis Federate prototype GUI will be accomplished at no cost to the government using previously developed government software.

## REQUIREMENTS AND MILESTONES

Phase 1. HLA Federate Analysis System Design.

- Perform Object Oriented Analysis of the Analysis Federate prototype (JAN 98).
- Develop Simulation Object Model of the Analysis Federate prototype (MAR 98).

Phase 2. Analysis Federate Prototype Development.

- Identify and develop Analysis Federate objects (JUL 98).
- Implement HLA RTI for HLA Analysis Federate (NOV 98).
- Conduct distributed simulation experiments (DEC 98).

Phase 3. Develop prototype and document results.

- Document Analysis Federate services (MAR 99).
- Document data collection procedures (MAY 99).
- Write Technical Report (JUL 99).

## DELIVERABLES

- HLA Analysis Federate prototype for data collection and analysis.
- Procedures for data collection in distributed simulation environments.
- Technical Report.

## ESTIMATED MAN YEARS

Requirement	Lead Investigator	Co-Investigator
Systems Engineering Design Process	1/2	1/8
Develop Analysis Federate Prototype	1/2	1/12
Refine, extend, and document study results	1/4	

## LEAD INVESTIGATOR

MAJ William S. Murphy Jr., TRAC-Monterey, P.O. Box 8692, Monterey, CA 93943. (831) 656-4056 (DSN 878). *murphyw@mtry.trac.nps.navy.mil*

## CO-INVESTIGATORS

Professor Arnold Buss, Department of Operations Research, Naval Postgraduate School, Monterey, CA 93943. (831) 656-3259. *bussa@or.nps.navy.mil*

LTC Mike McGinnis, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-3086 (DSN 878). *mcginnism@trac.nps.navy.mil*

## CONTRACTOR

Rolands & Associates (R&A), Mr. William Caldwell, 500 Sloat Avenue, Monterey, CA 93940. (831) 373-2841.

**REFERENCE**

Jackson, L. and R. Wood, "Exploring the High Level Architecture for Analysis in an Advanced Distributed Simulation," 1997 Spring Simulation Interoperability Workshop (SIW) Working Paper # 122, Orlando, FL.

## HLA WARRIOR

### PROJECT FY99-05

#### CLIENT ORGANIZATION

Headquarters, U.S. Army TRADOC Analysis Center (TRAC), ATTN: ATRC, Fort Leavenworth, KS 66027. Point of Contact: Mr. Michael F. Bauman, SES, Director, TRAC, Fort Leavenworth, KS 66027. DSN: 552-5132. *baumanm@trac.army.mil*

#### PROBLEM STATEMENT

Developers of next-generation simulations lack test cases to assess the benefit of applying modern technologies to combat simulations and to explore simulation integration issues. TRAC-Monterey and the National Simulation Center (NSC) propose to jointly research new computer software technologies and methodologies for re-hosting legacy computer simulations to modern platforms and paradigms. The primary purpose of this research is to investigate and demonstrate application of advanced technologies for re-engineering and re-hosting legacy simulations in support of future combat simulations, such as Combat XXI and OneSAF. Janus is the test case for this project.

Baseline requirements include porting Janus to a high-end personal computer (PC) running Windows NT (WinNT). This effort involves creating a new modular simulation architecture, rewriting source code using an object-oriented language, creating new graphical user interfaces (GUIs) using Vision XXI management tools, complying with Distributed Interactive Simulation (DIS) and High Level Architecture (HLA) requirements, and incorporating Janus version 6.3 with some Janus 6.88 functionality. When complete, the re-engineered model will be called *HLA Warrior*.

#### PROPOSAL OF WORK

This research will be accomplished in two phases. First, TRAC-Monterey coordinates and leads the re-engineering effort incorporating baseline requirements. Next, NSC assumes lead for integrating Operations Other Than War (OOTW) and Urban Warfare capability into the re-engineered model, as well as linking *HLA Warrior* to the Army's command, control, communications, computers, and intelligence (C4I) systems.

#### REQUIREMENTS AND MILESTONES

- First Beta release to test sites. Includes GUI functionality and limited model integration. (MAR 99)
- Second Beta release to test sites. Includes GUI functionality integrated with majority of model functionality. (JUL 99)
- Final prototype demonstration in a proof-of-principle exercise. (DEC 99)
- Write Technical Report. (APR 00)

#### DELIVERABLES

- Prototype HLA Warrior.
- Technical Report.

**ESTIMATED MAN YEARS**

Requirement	Lead Investigator	Co-Investigators	R&A	Tapestry Solutions
Set-up programming environment and train users.	1/10 yr		1/10 yr	1/10 yr
Develop object design of Janus.	1/10 yr	3/10 yr		
Develop and test GUI and integrate with model.	1/10 yr	1/10 yr		5/10 yr
Write and test source code to include all classes and algorithms.	1/10 yr	1/10 yr	8/10 yr	
Write technical report.	2/10			

**LEAD INVESTIGATOR**

MAJ Gerald M. Pearman, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4062 (DSN 878). [pearman@mtry.trac.nps.navy.mil](mailto:pearman@mtry.trac.nps.navy.mil)

**CO-INVESTIGATORS**

SFC Cary C. Augustine, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4059 (DSN 878). [augustic@trac.nps.navy.mil](mailto:augustic@trac.nps.navy.mil)

CPT(P) Theodore D. Dugone, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4057 (DSN 878). [dugonet@trac.nps.navy.mil](mailto:dugonet@trac.nps.navy.mil)

MAJ Leroy A. Jackson, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4061 (DSN 878). [jacksonl@trac.nps.navy.mil](mailto:jacksonl@trac.nps.navy.mil)

LTC Michael L. McGinnis, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4086 (DSN 878). [mcginnism@trac.nps.navy.mil](mailto:mcginnism@trac.nps.navy.mil)

MAJ William S. Murphy, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4056 (DSN 878). [murphyw@trac.nps.navy.mil](mailto:murphyw@trac.nps.navy.mil)

Naval Postgraduate School Computer Science Department. Professors Luqi, Shing, Berzins, and students CPT Julian Williams and CPT Mike Saluto, Naval Postgraduate School, Monterey, CA 93943. (831) 656-2735.

**CONTRACTORS**

Rolands & Associates (R&A), Mr. William Caldwell, 500 Sloat Avenue, Monterey, CA 93940. (831) 373-2841.

Tapestry Solutions, Inc., Galen Aswegan, 5675 Ruffin Road, Suite 305, San Diego, CA 92123. (619) 503-1990.

**REFERENCE:** None.

## **LAND WARRIOR SIMULATION AND TRAINING SUPPORT**

### **PROJECT FY99-06**

#### **CLIENT ORGANIZATIONS**

TRADOC Systems Manager (TSM)-Soldier, Attn: ATZD-TS, Fort Benning, Georgia 31905-5405. Point of Contact: LTC Pat Berger. DSN: 835-7738. *bergerp@benning-emh-2.army.mil*

U.S. Army Simulation, Training, and Instrumentation Command (STRICOM) ATTN: AMSTI-ES. 12350 Research Parkway, Orlando, FL 32826. Point of Contact: Mr. Traci Jones, Systems Engineer, STRICOM. DSN 970-3927. *Traci\_A.\_Jones@stricom.army.mil*

#### **PROBLEM STATEMENT**

The Land Warrior suite of combat systems designed for the dismounted infantry (DI) soldier provides dramatic increases in lethality, range, communications, and situational awareness. However, these tools only translate to increased combat effectiveness if properly employed on the battlefield. DI trainers must find the best method to train DI soldiers to operate Land Warrior sub-systems to achieve maximum combat power. DI trainers are cognizant of the new systems' complexity and the need for a departure from traditional DI training techniques. One method under exploration uses constructive or virtual simulations/simulators to supplement DI training. In addition to assisting with a soldier's initial and sustainment training on Land Warrior subsystems, simulations/simulators may have applicability to developing tactics, techniques, and procedures (TTPs) for collective employment.

#### **PROPOSAL OF WORK**

Leverage dismounted infantry training expertise resident at TRAC-Monterey to assist STRICOM with evaluations of Small Business Innovation Research (SBIR) proposals, advise client on status of SBIR awards, and participate in both the Warrior Systems Technology Based Executive Steering Committee (TBESC) and Dismounted Warrior Network (DWN).

Perform liaison duties between TSM-Soldier and industry on matters that pertain to Land Warrior and simulations. Review TTPs developed by a TSM-Soldier contractor and give recommendations to both contractor and TSM-Soldier. Additionally, develop techniques for training Land Warrior equipped DI. Training options explored will involve the use of live and virtual simulations. The objectives of the study are to: (1) analyze the tactics, techniques, and procedures and determine which TTPs are best suited for simulation training; (2) represent TSM-Soldier's interests to various M&S agencies as a subject matter expert; (3) participate in the initial train-up of the test platoon and provide training evaluation to TSM-Soldier.

#### **PROJECT REQUIREMENTS AND MILESTONES**

- Evaluation of Land Warrior test platoon's training package. (TBD)
- Hands on Land Warrior training with test platoon. (TBD)
- Review tactics, techniques, and procedures for Land Warrior training. (TBD)
- Review SBIR proposals for Land Warrior embedded training. (OCT 98)
- Advise Client of awarded SBIR Phase I contract (JAN-JUL 99)
- Provide Subject Matter Expertise to TBESC and DWN. (FY 99)

#### **PROJECT DELIVERABLES**

- Feedback to TSM Soldier on constructive and virtual training options for Land Warrior.

- On-site technical support.
- Written review of SBIR Phase I proposals.
- Two written evaluations of SBIR Phase I work.

#### **ESTIMATED MAN-YEARS REQUIRED**

Requirement	Lead Investigator	Co-Investigator
Review SBIR proposals for Land Warrior embedded training.	1/16	1/32
Advise Client on awarded SBIR Phase I contract status.	1/8	
Provide Subject Matter Expertise to the TBESC and DWN.	1/16	
Evaluate Land Warrior test platoon's training package.	1/10	1/32
Conduct hands-on Land Warrior training with test platoon.	1/10	
Review tactics, techniques, and procedures for Land Warrior training.	1/8	

#### **LEAD INVESTIGATOR**

SFC Cary C. Augustine, TRAC-Monterey, PO BOX 8692, Monterey, CA 93943. (831) 656-4059 (DSN 878). *augustic@mtry.trac.nps.navy.mil*

#### **CO-INVESTIGATOR**

Ms. Shirley M. Pratt, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (407) 673-3610. *pratts@gdi.net*

**CONTRACTOR:** None.

**REFERENCE:** None.

## **MODULAR TERRAIN FOR ENTITY LEVEL COMPUTER GENERATED FORCES (ModTerrain)**

### **PROJECT FY99-07**

#### **CLIENT ORGANIZATIONS**

Headquarters, US Army Training and Doctrine Command (TRADOC) Deputy Chief of Staff for Simulations, Studies, and Analysis, Attn: ATAN, TRADOC Project Officer OneSAF. Point of Contact: LTC David Vaden. DSN 680-5954. *vadend@monroe.army.mil*

Headquarters, US Army TRADOC Analysis Center (TRAC), Warrior Project Officer. Point of Contact: MAJ Gerald Pearman. DSN 878-4062. *pearman@trac.nps.navy.mil*

#### **PROBLEM STATEMENT**

Terrain correlation continues to be one of the most pressing interoperability issues in the use of distributed simulations. Terrain mis-correlation causes a number of undesirable effects such as unfair fights among entities, degraded simulation realism, and invalid exercise results. For simulations of Computer Generated Forces (CGF), terrain correlation problems can be largely attributed to a lack of database interchange formats and to differences in runtime terrain representations. For visually oriented simulators/simulations, internal processing and graphical display of terrain databases further contribute to correlation problems.

The High Level Architecture (HLA) has been designed to facilitate interoperability of all type of models and simulations, as well as component reuse. It does not, however, ensure that synthetic environment databases used by heterogeneous simulation systems are correlated (i.e., spatially consistent).

The Synthetic Environment Data Representation Interchange Specification (SEDRIS) provides a mechanism for unambiguous and loss-less interchange of data for synthetic environment databases. SEDRIS furthers interoperability significantly, however, applications will continue to use dissimilar runtime terrain representations. Some of the derived runtime terrain databases may be based on an irregular network of polygons (polygonal type) while others may be based on a regular grid (gridded type). Runtime terrain databases with similar representations may have very different resolution limitations. Correlation problems will still arise when simulations using dissimilar runtime representations are linked together.

Composability and interoperability were identified as two of the three highest technical risks in OneSAF development. The limiting factor in simulation scalability is often the run-time terrain database resolution capacity. OneSAF operation requirements document (ORD) requires that "the OneSAF architecture must be able to operate using multiple terrain database formats." The OneSAF technical analysis concludes that the architecture "should provide uniform APIs between major system partitions and enforce the consistent use of these interfaces across the system to facilitate software maintenance and evolution." In most simulations terrain is partitioned with externally defined terrain database files.

#### **PROPOSAL OF WORK**

We propose to design an interface and prototype a modular run-time terrain component that will hide the details of the terrain representation from an entity level CGF system. This is much like the mechanism provided by HLA to abstract away the details of data distribution management. This component will contain a standard set of terrain services that will allow the application to use the terrain database independent of the underlying terrain representation. By using such a set of routines, legacy simulations and emerging CGF systems can use different



terrain formats at run-time without source code changes. The run-time terrain representation could also be changed internally without impacting systems that already use the existing set of standard terrain services. Also, the interface could be extended to provide those services not anticipated or not currently required by most CGF systems.

The project team will (1) study several run-time terrain formats such as ModSAF CTDB, CCTT SIF++, Multigen FLT, and Janus; (2) identify the common terrain services within entity level CGF systems; (3) examine some commonly used interchange representations such as SEDRIS, S1000, and Multigen FLT; (4) develop an API specification for a standard set of CGF terrain services; (5) code one baseline prototype terrain module using the API; (6) experiment with the baseline terrain module to determine its performance properties; (7) obtain two run-time terrain databases derived from a common source; and (7) demonstrate that an entity level simulation can use either module in a simulation exercise.

## REQUIREMENTS AND MILESTONES

The project consists of three distinct phases each culminating with the distribution of a written product or report.

*Phase I. Preliminary API Definition (March 1999).* In Phase I, we propose a standard API definition and develop a detailed implementation methodology. Phase I culminates with the distribution of a draft API standard to the SAF, Terrain and Object Management SCCs.

*Phase II. Prototype Development & Experimentation (September 1999).* In Phase II, we implement a prototype terrain module using the draft standard and conduct a series of experiments to benchmark the performance characteristics of the prototype. We will write an interim technical report to detail the API specification, describe the prototype implementation, and document the experimental results prototype testing. Phase II culminates with the distribution of the interim technical report.

*Phase III. Demonstration, Testing & Documentation (June 2000).* In Phase III, we integrate the prototype terrain module into an entity level simulation and demonstrate that composability has been attained. The demonstration (POP-D) will prove that an entity level simulation can use two different run-time terrain representations through the standard API. Phase III culminates with the distribution of a final technical report detailing the results for the entire project.

## DELIVERABLES

- Standards nomination for the run-time terrain module API specification.
- A prototype (ModSAF CTDB or similar) run-time terrain module using the standard.
- An interim technical report.
- A proof-of-principle demonstration (POP-D).
- A final technical report.

We will deliver the draft API specification in March 1999, the interim report in September 1999, and the final technical report in June 2000.

**ESTIMATED MAN YEARS**

Requirement	Ms. Pratt	MAJ Jackson	Dr. Buss	Dr. Pratt
Phase I.	1/6	1/12	1/12	1/24
Phase II.	1/3	1/12	1/24	1/24
Phase III.	1/4	1/12	1/24	1/24

**LEAD INVESTIGATORS**

Ms. Shirley M. Pratt, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (407) 673-3610.  
*pratts@gdi.net*

**CO-INVESTIGATORS**

Dr. Arnold Buss, Department of Operations Research, Naval Postgraduate School Monterey, CA 93943. (831) 656-3259. *bussa@or.nps.navy.mil*

MAJ Leroy A. Jackson, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4061(DSN 878). *jacksonl@trac.nps.navy.mil*

Dr. David Pratt, Department of Computer Science, Naval Postgraduate School, (407) 384-5506.  
*pratt@cs.nps.navy.mil*

**CONTRACTOR:** None.

**REFERENCE:** None.

## ONESAF VERIFICATION AND VALIDATION

### PROJECT FY 99-08

#### CLIENT ORGANIZATION

Simulation, Training, and Instrumentation Command (STRICOM), ATTN: PM-C4ISS, 12350  
Research Parkway, Orlando, FL 32826. Point of Contact: MAJ Jim Vaglia, (407) 384-3624.  
*vagliaj@stricom.army.mil*

#### PROBLEM STATEMENT

In 1992, the Defense Advanced Research Projects Agency (DARPA) initiated Modular Semi-Automated Forces (ModSAF) software architecture development and prototyping as a replacement for SIMNET SAF. It was originally designed as an extensible set of reusable software modules that would allow rapid development and testing of new functionality in distributed simulation environments. Later, its use was expanded to generating large numbers of simulated forces at Battlefield Distributed Simulation-Developmental (BDS-D) sites throughout the Army for exercises that often involved simulators. ModSAF's behavioral representation and computationally efficient methods make it attractive to the simulation community for model development, but these features also cause a reliance on human-in-the-loop intervention in behavioral execution.

Because of the importance of the OneSAF system to major programs such as WARSIM, and because of the impending retirement of entity based models such as Janus and ModSAF, the validity and credibility of the OneSAF development effort is extremely important. Therefore, the OneSAF verification and validation program must be developed and implemented to support that objective. Also, as cost constraints must also be considered, the V&V program must be operated using OneSAF IPT team members and contractor resources.

#### PROPOSAL OF WORK

Develop an overall V&V strategy for the OneSAF Test Bed as well as the OneSAF Objective architecture.

#### REQUIREMENTS AND MILESTONES

- OneSAF V&V Plan (OCT 98).
- OneSAF Beta test site plan (DEC 98).
- Conduct validation of interim test bed release (MAR 99).
- Report conclusions and recommendations (AUG 99).

#### DELIVERABLES

- V&V Assessment.

#### ESTIMATED MAN YEARS

Requirement	Lead Investigator
Develop V&V Plan	1/4 yr
Conduct validation testing	1/2 yr
Write V&V Assessment	1/4 yr

#### LEAD INVESTIGATOR

Ms. Pamela I. Blechinger, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (415) 751-8855. *blechinp@trac.army.mil*

**CO-INVESTIGATOR**

MAJ Gerald M. Pearman, TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-4062 (DSN 878). *pearman@trac.nps.navy.mil*

**CONTRACTOR:** None.

**REFERENCES**

Blechinger, Pamela, "ModSAF: An Overall V&V Assessment," September, 1998.  
Blechinger, Pamela, "OneSAF V&V Plan", October, 1998.

## **STANDARD SCENARIO MARK-UP LANGUAGE (S2ML)**

### **PROJECT FY99-09**

#### **CLIENT ORGANIZATION**

Army Model & Simulation Office (AMSO), Standard Category Coordinator for Functional Description of the Battlespace, ODCSOPS, ATTN: DAMO-ZS (LTC Timian), 400 Army Pentagon, Washington, DC 20310-0400. Point of Contact: LTC George Stone, JSIMS JPO, 12249 Science Drive, Suite 260, Orlando, FL 32826. 407-384-5554 (DSN) 970.  
*George\_Stone@jsims.mil*

#### **PROBLEM STATEMENT**

The Standard Scenario Mark-up Language (S2ML) will enable constructive and virtual simulations to seamlessly interpret scenarios across simulation environments, fidelities, and granularities. This standard will capture the order of battle (units, equipment, & task organization), missions, tasks, and control measures data sufficient to completely and uniquely describe a military scenario in a computer hardware and simulation independent form. The standard will include data and meta-data for security, marking the scenario contents as well as managing scenario configurations. This project will survey existing and planned simulation tools to identify essential and optional data required to initialize a computerized scenario. Then a standardized mark-up language modeled after HTML will be developed to foster scenario reuse across domains and among simulators and simulations.

#### **PROPOSAL OF WORK**

Identify candidate tools in each domain to survey. Interview code writers & review documentation to determine current & evolving scenario file contents. Develop a candidate standards document that captures a mark-up language for essential and optional scenario content. Staff the proposed standard within the Army simulation community (to include industry) for comments. Respond to staffing comments & concerns. Propose the standard using the AMSO Standards Nomination and Approval Process (SNAP) format.

#### **REQUIREMENTS AND MILESTONES**

- Initial Tools Selection (NOV 99)
- Survey Schedule Coordinated (DEC 99)
- Initial Surveys Completed (FEB 99)
- Survey Summary IPR (MAR 99)
- Draft Standard Development (MAY 99)
- Staffing Draft Standard (JUL 99)
- Comments Considered (AUG 99)
- Draft Report (JUL 99)
- SNAP Submission (SEP 99)
- Final Report (MAR 00)

#### **DELIVERABLES**

- Draft Standard Scenario Mark-up Language Document.
- Report of Activity & Consideration of Comments to the Draft S2ML Standard.

**ESTIMATED MAN YEARS:**

Requirement	Lead Investigator
Initial Tools Selection	1/24
Survey Schedule Coordinated	1/24
Initial Surveys Completed	1/24
Survey Summary IPR	1/24
Draft Standard Development	1/12
Staffing Draft Standard	1/12
Comments Considered	1/12
Draft Report	1/12
SNAP Submission	1/12
Final Report	1/12

**LEAD INVESTIGATOR**

CPT(P) Theodore D. Dugone, TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-4057 (DSN 878). *dugonet@trac.nps.navy.mil*

**CO-INVESTIGATOR**

MAJ Leroy A. Jackson, TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-3086 (DSN 878). *jacksonl@trac.nps.navy.mil*

**CONTRACTOR:** TBD.

**REFERENCE**

Army Model Improvement Program nomination AMIP-98-FDB-01.

## IV. MILITARY OPERATIONS RESEARCH FOR FY99

### A GRAPH AND NETWORK COMPONENT FOR DYNAMIC PLANNING IN A LOOSELY COUPLED SYSTEM (KÖNIG)

#### PROJECT FY98-08

#### CLIENT ORGANIZATIONS

Air Force Office of Scientific Research, ATTN: Dr. Neal Glassman (Code NM), 110 Duncan Avenue, Suite 100, Bolling AFB, Washington D.C. 20332-0001. Point of Contact: Dr. Neal Glassman (Code NM). (202) 767-5026. [neal.glassman@afosr.af.mil](mailto:neal.glassman@afosr.af.mil)

Office of Naval Research, ATTN: Dr. Donald K. Wagner, Division of Mathematical Sciences Code 1111, 800 N. Quincy Street, Alexandria, VA 22217-5000. Point of Contact: Dr. Donald K. Wagner. (703) 696-4313. [wagnerd@onr.navy.mil](mailto:wagnerd@onr.navy.mil)

#### PROBLEM STATEMENT

Military planning systems must evolve to meet the challenges of conducting military operations in the information age. *Department of Defense Joint Vision 2010* and *Air Force New World Vistas* suggest the next generation of military planning systems will accelerate the tempo of analysis, operate over computer networks and on different computer platforms, and incorporate simulation technology for mission planning. Even the best-integrated planning tools today do not provide adequate interoperability, platform independence, or extensibility. Future planning systems must address new situations and needs of decision-makers that designers have not yet anticipated. These planning systems will feature an open architecture enabling new functions and capabilities to be added without disruption.

Incorporating graph and network models, and associated algorithms, into a dynamic military planning system has great potential for overcoming the shortcomings noted above. Traditional uses of graph and network models include planning, optimization, and simulation. Graph and network models, implemented in a loosely coupled dynamic planning system through a set of Java interfaces may provide the flexibility and adaptability needed in military planning and decision-making systems of the future.

#### PROPOSAL OF WORK

Design and develop an extensible library of graph and network algorithms for military planning in dynamic, distributed systems. Implement selected graph and network algorithms as a component (i.e., module) of a loosely coupled dynamic planning system.

#### REQUIREMENTS AND MILESTONES

- Design Java interfaces and classes for graph and network algorithms in a loosely coupled dynamic planning system. This will include developing an extensible subset of classes and subclasses to support system functions. Generic programming concepts will be used to design interfaces so future algorithms may be easily incorporated into the loosely coupled system.
- Implement algorithms and classes to produce a graph and network component prototype.
- Conduct formal component prototype testing and integrate the component into the dynamic planning system.

**DELIVERABLES**

- Graph and network component architecture and Java class descriptions.
- Graph and network component prototype programmed in Java.
- Technical report.
- Proof-of-principle demonstration (POP-D) of the dynamic planning system with the graph and network component.

**ESTIMATED MAN YEARS**

Requirement	Lead Investigator	Co-Investigators
Analysis and design	1/6	1/12
Component implementation	1/6	1/12
System integration and testing	1/12	1/6
Documentation	1/6	1/12

**LEAD INVESTIGATOR**

MAJ Leroy A. Jackson, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4061 (DSN 878). [jacksonl@trac.nps.navy.mil](mailto:jacksonl@trac.nps.navy.mil)

**CO-INVESTIGATORS**

Professor Gordon H. Bradley, Department of Operations Research, Naval Postgraduate School, Monterey, CA 93943. (831) 656-3259. [bradley@or.nps.navy.mil](mailto:bradley@or.nps.navy.mil)

Professor Arnold Buss, Department of Operations Research, Naval Postgraduate School, Monterey, CA 93943. (831) 656-3259. [bussa@or.nps.navy.mil](mailto:bussa@or.nps.navy.mil)

LTC Michael L. McGinnis, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-3088 (DSN 878). [mcginnism@trac.nps.navy.mil](mailto:mcginnism@trac.nps.navy.mil)

**CONTRACTOR:** None

**REFERENCES**

- Army Vision 2010, Department of the Army, <http://160.147.68.21:80/2010/>
- Bradley, G., "Dynamic and Interactive Electronic Research Publications Using Java," February 1996, Technical Report Online at <http://web.nps.navy.mil/~gbradley>
- Bradley, G. and A. Buss, unpublished research report entitled "An Architecture for Dynamic Planning Using Loosely Coupled Components," July 1997.
- Buss, A. and K. Stork, "Discrete-Event Simulation on the World Wide Web Using Java," Proceedings of the 1996 Winter Simulation Conference, December 1996.
- Department of the Air Force, New World Vistas: Air and Space Power for the 21<sup>st</sup> Century, <http://web.fie.com/htdoc/fed/afr/sab/any/text/any/vistas.htm>, 15 December 1995.
- Department of Defense, Chairman of the Joint Chiefs of Staff, Joint Vision 2010, <http://www.dtic.mil:80/doctrine/jv2010/>
- Jackson, L., "Graph Standard Project," online research proposal located at <http://www.trac.nps.navy.mil/~jacksonl/OA4910/project/project.html>, August 1996.
- Gamma, Erich, Richard Helm, Ralph Johnson and John Vlissides, "Design Patterns, Elements of Reusable Object-Oriented Software," Addison-Wesley, 1995.



## **ARMY CENTER FOR ACQUISITION LESSONS LEARNED**

### **PROJECT FY99-10**

#### **CLIENT ORGANIZATION**

Assistant Secretary of the Army for Research, Development, and Acquisition, 103 Army  
Pentagon, Washington, D.C., 20310-0103

#### **PROBLEM STATEMENT**

No central data repository exists to capture and rapidly disseminate Army acquisition lessons learned. A virtual center for lessons learned will:

- Allow researchers to focus research resources on relevant and important acquisition issues.
- Provide a means to make research results accessible to the acquisition community.
- Serve as an integrating mechanism for acquisition research needs of warfighters, policy-makers, and practitioners.

#### **PROPOSAL OF WORK**

Develop, field, and maintain a web-based data warehouse containing Army acquisition lessons learned.

#### **REQUIREMENTS AND MILESTONES**

- Development (Oct-Dec 98)
- Implementation and Operation (Jan-Sep 99)
- Lessons Learned Research (on-going through FY99)

#### **DELIVERABLES**

- Site design document.
- Administration policies document.
- Populated product database.
- Implement and maintain web site.

#### **ESTIMATED MAN YEARS:**

Requirement	Lead Investigator	Co-Investigators
Development	1/12	1/12 yr
Implementation and Operation	1/12	1/12 yr
Lessons Learned Research	1/12	1/12 yr

#### **LEAD INVESTIGATOR**

LTC Michael L. McGinnis, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4086 (DSN 878). *mcginnism@trac.nps.navy.mil*

#### **CO-INVESTIGATORS**

MAJ William S. Murphy, Jr., TRAC-Monterey, PO Box 8692 Monterey, CA 93943. (831) 656-4056 (DSN 878). *murphyw@trac.nps.navy.mil*

Dr. Mark E. Nissen, Department of Systems Management, Naval Postgraduate School, Monterey, CA 93943. (831) 656-3570. *mnissen@nps.navy.mil*

Dr. Keith F. Snyder, Department of Systems Management, Naval Postgraduate School,  
Monterey, CA 93943. (831) 656-3621. *ksnider@nps.navy.mil*

**CONTRACTOR:** None.

**REFERENCE:** None.

## COMBAT IDENTIFICATION (CID) PROJECT

### PROJECT FY99-11

#### CLIENT ORGANIZATION

J-8/Simulation & Analysis Management Division (SAMD), Pentagon Room 1D940, Washington, D.C. 20318-8000. Point of Contact: LTC Mark Tilman, Action Officer, Collaborative Analysis Branch, J-8/SAMD. (703) 693-4607. *tillmame@js.pentagon.mil*.

#### PROBLEM STATEMENT

The high number of fratricide incidents during Desert Storm alarmed senior military leaders. As a result, the joint staff directed development and fielding of Combat Identification (CID) systems that prevent fratricide. These immature systems require testing to thoroughly assess their impact on the force. Testing includes developing measures of effectiveness (MOEs) as metrics to determine the usefulness of the system. The analyst will use MOEs to test system effectiveness in a combined arms scenario. One method of testing involves modeling the CID system in a computer simulation. The simulation provides data to assess the impact of the CID system and allows comparison of different systems currently available.

#### PROPOSAL OF WORK

The project will develop a methodology for assessing the capabilities of CID systems, to include developing valid MOEs for testing and conducting data analysis of CID systems modeled in the SIMKIT based simulation.

#### REQUIREMENTS AND MILESTONES

- Developed Measures of Effectiveness (DEC 98).
- CID systems modeled in SIMKIT (FEB 99).
- Data gathered from SIMKIT runs (APR 99).
- Report conclusions in thesis (JUN 99).
- Write Technical Report (SEP 99).

#### DELIVERABLES

- Masters Thesis.
- Technical Report.

#### ESTIMATED MAN YEARS

Requirement	Lead Investigator	Co-Investigators
Develop measures of effectiveness (MOEs)		1/12 yr
Model CID systems in SIMKIT	1/24 yr	2/12 yr
Data analysis	1/24 yr	2/12 yr
Write thesis	1/12 yr	2/12 yr
Write technical report	1/12 yr	

#### LEAD INVESTIGATOR

MAJ Gerald M. Pearman, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4062 (DSN 878). *pearman@mtry.trac.nps.navy.mil*

**CO-INVESTIGATORS**

Professor Arnold Buss, Department of Operations Research, Naval Postgraduate School,  
Monterey, CA 93943. (831) 656-3259 (DSN 878). *bussa@or.nps.navy.mil*

CPT Mark Grabski, Student Department of Operations Research, Naval Postgraduate School,  
Monterey, CA 93943. (831) 656-3086 (DSN 878). *mvgrabsk@nps.navy.mil*

LTC Michael McGinnis, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-  
4086 (DSN 878). *mcginnism@mtry.trac.nps.navy.mil*

**CONTRACTOR:** None.

**REFERENCE:** None.

## **FORECASTING TOOLS FOR MILITARY HOUSING REQUIREMENTS**

### **PROJECT FY99-12**

#### **CLIENT ORGANIZATIONS**

Headquarters, Naval Postgraduate School (NPS), Monterey, CA 93943. Point of Contact: CAPT Deane K. Gibson, Commanding Officer, Naval Support Activity. (831) 656-2406. *dkgibson@nps.navy.mil*

Headquarters, Presidio of Monterey (POM), Monterey, CA 93943. Point of Contact: COL Peter G. Dausen, Garrison Commander. (831) 242-6518. *dausenp@pom-emhl.army.mil*

#### **PROBLEM STATEMENT**

The Naval Support Activity (NSA) at the Naval Postgraduate School (NPS) administers military housing on the Monterey Peninsula. This housing exists on four locations, La Mesa Village, Presidio of Monterey (POM), POM Annex, and NPS. Residents include service members from all branches of military service assigned to NPS, the Defense Language Institute Foreign Language Center (DLIFLC), and other tenant activities. A large student population creates a high turnover rate and presents challenges to housing managers forecasting future housing requirements. This project provides tools to assist the housing director assess future housing requirements. Previous TRAC-Monterey work provided technical support developing the housing office's web site. The site includes a page permitting customers to register on-line with the housing office by answering a series of prompted questions. This registration is currently forwarded to the housing office via e-mail with no automated data consolidation system. The registration page will better serve housing office counselors if the information is sent to a database rather than directly the counselor's email address. Once in the database, information could be queried as necessary to assess housing requirements. Assuming some customers do not have web access, TRAC-Monterey will design a registration card in the same format as the electronic registration page. The card will be included in welcome packets sent to all inbound military personnel with instructions to complete and return to the housing office if unable to access the electronic registration page. The combination of capturing registration information in a database and providing registration cards to all inbound service members will significantly enhance the housing director's ability to forecast housing requirements.

#### **PROPOSAL OF WORK**

TRAC-Monterey will assist a private contractor establishing a database that captures information from the electronic registration page on the housing web site. Assistance includes establishing restricted permissions to allow the contractor access to TRAC-Monterey's server (location of housing web site), technical advice regarding selection of a commercial database, and coordination with housing office to ensure database is easily accessible. TRAC-Monterey will also design a registration card, coordinate with housing office to mass produce cards, and facilitate distribution of cards to local commands for inclusion in welcome packets.

#### **REQUIREMENTS AND MILESTONES**

- Provide restricted permissions to access TRAC-Monterey server (NOV 98).
- Technical advice on commercial database (JAN 99).
- Coordination with housing office to use database (JAN 99).
- Design registration card (FEB 99).
- Write technical report (SEP 99).

**DELIVERABLES**

- Registration card.
- Technical Report.

**ESTIMATED MAN YEARS**

Requirement	Lead Investigator	Co-Investigator
Restricted permissions to server		1/24
Technical advise on commercial database	1/24 yr	
Coordination with housing office for database use	1/24 yr	
Design registration card	1/24 yr	
Write technical report	1/24 yr	

**LEAD INVESTIGATOR**

MAJ Gerald M. Pearman, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4062 (DSN 878). *pearman@etry.trac.nps.navy.mil*

**CO-INVESTIGATORS**

Mr. Jeff Ingram, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4095 (DSN 878). *ingramj@etry.trac.nps.navy.mil*

CPT David Shade, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (831) 656-4033 (DSN 878). *shaded@etry.trac.nps.navy.mil*

**CONTRACTOR:** None.

**REFERENCE:** None.

## LAND WARRIOR TRAINING EFFECTIVENESS ANALYSIS

### PROJECT FY99-13

#### CLIENT ORGANIZATION

TRADOC Systems Manager-Soldier, Attn: ATZB-TS, Fort Benning, Georgia 31905-5405.

Point of Contact: LTC Pat Berger, Director, TSM Soldier. DSN 835-7738.

*bergerp@benning-emh-2.army.mil*

#### PROBLEM STATEMENT

The Client wishes to evaluate initial Land Warrior training effectiveness prior to platoon level field tests. Once in the field, the Client also wishes to evaluate Land Warrior system effectiveness measured against traditional performance metrics.

#### PROPOSAL OF WORK

Leverage dismounted infantry training expertise resident at TRAC-Monterey to assist with a Land Warrior field data collection and analysis effort by Army Research Institute (ARI)-Fort Benning. Additionally, through training and field-testing observations, contribute to a Training Effectiveness Analysis (TEA) technical report.

#### PROJECT REQUIREMENTS AND MILESTONES

- Evaluate Land Warrior test platoon training package. (TBD)
- Observe Land Warrior test platoon field tests. (TBD)
- Contribute to Training Effectiveness Analysis technical report. (TBD)

#### PROJECT DELIVERABLES

- Assist ARI with experimental design as required.
- On-site evaluation and technical assistance.
- Technical report assistance to ARI.

#### ESTIMATED MAN-YEARS REQUIRED

Requirement	Lead Investigator	Co-Investigator
Evaluate Land Warrior test platoon's training package.	1/10	1/10
Observe and evaluate Land Warrior test platoon field test.	1/6	1/6
Contribute to TEA technical report.	1/6	1/6

#### LEAD INVESTIGATOR

SFC Cary C. Augustine, TRAC-Monterey, PO BOX 8692, Monterey, CA 93943. (831) 656-4059 (DSN 878). *augustic@mtry.trac.nps.navy.mil*

#### CO-INVESTIGATORS

Dr. Jean Dyer, ARI-Fort Benning, PO Box 52086, Fort Benning, GA 31995-2086. DSN 835-4513. *dyerj@benning.army.mil*

Ms. Shirley M. Pratt, TRAC-Monterey, PO Box 8692, Monterey, CA 93943. (407) 673-3610. *pratts@gdi.net*

**CONTRACTOR:** None.

**REFERENCE:** None.